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REVIEWS OF RECENT LITERATURE.

Animal Psychology.[1] — Every book which comes to us from the direct and faithful observer of psychical development in the lower animals is doubly to be welcomed: first, for our abiding interest in them which makes every trait of theirs worth knowing for its own sake; and, second, for the light which a study of their nature throws upon the problems of human psychology. Among the latest of these contributors is Prof. Wesley Mills, of McGill University, Montreal, who has been known for a score of years as a successful breeder of dogs and a close student of the habits and development of this and allied species of animals. The book consists of four parts. The first of these comprises a group of essays and addresses upon the methods and the value of Comparative Psychology; the second deals with the phenomena of hibernation, feigning and allied states among animals, and with analogous states obtaining in human subjects; the third and most important section of the work consists of detailed original observations upon the physical and psychical development of animals, supplemented freely by constructive criticism; and in the fourth is added the reprint of a series of discussions upon the nature of instinctive tendencies, which appeared originally in *Science*, 1896. The papers which form the preceding parts of the book were first published in *Science*, *Popular Science Monthly*, and other periodicals, and in the *Transactions of the Royal Society of Canada.*

Professor Mills comes to his work well fitted by years of patient and direct study of animals in his own warrens and breeding kennels; and only such work as his will be of final value for the science of animal and comparative psychology. "Closet psychology," he says, "cannot hope to accomplish much." "He who would understand animals thoroughly must live among them, endeavor to think as they think and feel as they feel, and this at every stage in their development."

At the outset the author makes plain his conception of the impulse to animal study and the nature of its problems. Our interest is based upon an interpretation of animal nature through the analogy of our own. "We make the world of animal life about us a reflection of ourselves; we spontaneously implant in the bird and the squirrel qualities that are our own. They interest us in proportion as they seem to embody the same thoughts and feelings as ourselves." But this is not the only, nor, indeed, the most important aspect of the study. The science of physiology has grown up almost wholly through experiments performed upon the lower animals; we must apply the same method to psychology; to understand adequately the processes of the human mind, we must study the nature and development of more primitive forms of life. A few words will indicate the relations in which the results of animal psychology have an important bearing upon the questions of human psychology.

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[1] Mills, Wesley, M.A., M.D., F.R.S.C., etc., Professor of Physiology in McGill University, Montreal, Canada. *The Nature and Development of Animal Intelligence.* The Macmillan Company, 8vo., pp. 300. $2.00.

It is scarcely a generation since the first psychological laboratories were founded; but in the brief years which have intervened between that time and this there have grown up dozens of such experimental stations, in which skilled observers carry on patient and detailed study of the phenomena of our mental life.

One of the chief difficulties which these experimental psychologists have to solve is the production of a naïve attitude in the subject of the experiment. The mature human being is a mass of ingrained conventions which very greatly transform his original impulses. The primary reaction, the elementary motif, the native trend of desire, the unqualified conviction, are overlaid and disguised by a thousand modifying considerations and restraints imposed upon him by the very form of his social life. He clothes himself in inhibitions as in a garment, and anything which will aid in stripping off this fabric of secondary impulses, and secure for the student a direct observation of the naked tendency, is to be welcomed for the light it throws upon the complex object of his study.

To simplify the conditions under which the mental process takes place, and at the same time to maintain its typical character, is the problem of the psychological investigator; and to fulfill these requirements he goes far afield from the study of the normal adult subject and calls many diverse observers to his aid.

The pursuit of these simpler conditions has gone in two main directions: first, into the province of pathology, where abnormal variations have presented certain elements so heightened in value that the network of ordinary inhibitions has been torn away and the exaggerated impulses can be observed with a directness unattainable in the normal individual; and, second, into the realm of more primitive forms of life, in which the activities common to them and the mature human subject have not been obscured by the counter-play of motives and restraints. Observations in both these fields are accumulating at an immensely rapid rate. Psychiatry has a literature of its own, while the index to works on hypnotism, hysteria, and allied states fills a volume of itself. One can scarcely take up a periodical — popular or technically psychological — without running across either a monograph on this or that phase of child-study, or a notice of some new book on the subject. The habits and peculiarities of the lower species of animals, the character of their sense perceptions, and the nature of their intelligence have long been studied, but rather as classes apart from each other and from man, and not as members of a common genetic group. We need a truly comparative psychology, which, by diligent study of the psychic life of all orders accessible to observation, will seek to show us what the intimate nature of the process of mental development actually is, and to trace back the developed processes manifested in the higher species to their roots in the primitive forms of action and reaction which comprise the mental activities of the more elementary forms of life.

The reflex and subliminal regions of consciousness are full of unsolved problems; instincts, automatisms, whims, and idiosyncrasies, and all such marginal phenomena are things out of the unplumbed depths of our nature upon which biological psychology is bound to pour a flood of light. We need a paleontology of the soul, and the only instrument at hand by which we can probe the region of its vanished growth is that of comparison with the activities of those simpler forms which are now to be found in the child and the lower animal. The child is always with us, and it needs but patience and faithfulness of observation to exploit its nature; but for the study of lower forms of life we need laboratories, of which aquaria and vivaria are but the beginning, in which systematic observation of a wide variety of animal life shall be carried on. Already a move in this direction has been made by more than one university; an increasing number of students are coming to us from zoological museums and laboratories, and many signs point to a rapid and extensive development of biological psychology.

The work which the laboratory of biological psychology shall carry on more systematically and comprehensively, — the patient and sympathetic study of wild and domestic animals, vertebrate and invertebrate alike, — has already assumed great importance at the hands of many individual investigators, who, like our author, look upon the whole animal kingdom as parts of one genetic scheme, in which the activities and traits of the beasts find their significance not through any fanciful analogy, but because they are the actual prototypes of the mental processes of the human mind itself. "If we regard man as the outcome of development through lower forms, according to variation with natural selection — in a word, if man is the final link in a long chain binding the whole animal creation together, we have the greater reason for inferring that comparative psychology and human psychology have common roots. We must, in fact, believe in a mental or psychical evolution as well as in a physical (morphological) one" (p. 20).

Into the detailed results of Professor Mills's work we cannot enter here, but the problems with which comparative psychology has mainly to grapple can be stated in a few lines.

1. Imagination in animals, the power to frame mental pictures of absent objects.
2. The fact and extent of the power to count and deal with measurable quantities in general.
3. The capacity to generalize upon details and to form abstract ideas.
4. The sense of right and wrong, and the nature of moral sanction among the brutes.
5. Their comprehension of man's various forms of expression and the extent of their power of communication between each other.
6. The homing and migrating instincts of animals and their reappearance in man.
7. The laws of heredity and susceptibility of animals to modification through environment.

Towards the solution of these problems Mr. Mills professes to contribute only material; he is sparing in his deductions and faithful to the fact. "Plainly," he says, "it will be desirable to keep our facts very sharply apart from our explanations. The science of psychology is a very youthful one; that of comparative psychology still more so; and at the present stage of the science any one who contributes a single fact will be a real friend to its progress." The book is chiefly contributory of material, it is true, and such work is long in process, and its conclusions concerning individual functions and species of animals are fragmentary and tentative; but such delving must necessarily precede and underlie all constructive theory.

Mr. Mills's work shows in a marked degree a qualification upon which must be founded all really successful study of animal life;

he is a lover of dumb beasts as well as a student of their ways; and throughout his writing there breathes a frank and open spirit of inquiry, and a fitness of style which increases the acceptability of his work. In its sympathy and kindly appreciation for animals, its modesty, and its sanity and moderation of statement, the book is one of the most hopeful of recent contributions to the study of animal intelligence.

ROBERT MACDOUGALL.

CAMBRIDGE, MASS.

We have received the volume of *Naturæ Novitates* for 1897 from the publishers, R. Friedländer & Sohn, Berlin. This useful work, comprising, as it does, notices of all the more important books and articles of the year in Natural History and the exact sciences, together with valuable Personalia, deserves to be more widely known and used in this country.

GENERAL BIOLOGY.

Animal Grafts. — In the *Sitzungsberichte der Gesellschaft zu Marburg*, Jahrgang 1897, F. Marchand describes several sets of successful experiments in grafting one part of the body upon another part. Thus, in the rabbit he has transplanted the cornea of the eye from one animal to the eye of another, and the transplanted part has taken root, as it were, so that in time the eye appears normal. He has repeated the older experiment of ingrafting the tail of a young rat under the skin of its own back. The tail continues to grow as it would have done in its normal position. The tail makes connections with the blood system of the body in its new location, and these connecting vessels become large enough to carry on the nutrition of the parasitic tail. It is a case of perfect adjustment of the organism to new conditions.

Regeneration of Extirpated Limbs. — Miss Byrnes (*Anat. Anz.*, 1898) has destroyed, by means of a hot needle, the body-wall musculature in young tadpoles at the point where limbs were about to arise. Soon after the operation the cells lying ventral to the wound pushed up and closed it. From this tissue, which normally has nothing to do with forming the limb, the limb arises in normal form and size. [It may be added that this result is less properly called regeneration, which more frequently implies development from a rudiment of the regenerating organ, than regulation, by which a part — the ventral